What is claimed is:

1. A label switch network system having a plurality of label switch nodes interconnected by network links where layer 2 paths are set up by specified routes between the plurality of label

5   switch nodes from a network ingress to a network egress, comprising:

an ingress node which is disposed at the ingress of the label switch network that transfers packets corresponding to packet flows based on labels, and which selects and sets up

10   layer 2 paths for transferring the packets with reference to the header or payload information of the packets;

a policy server that instructs the ingress node to set up the layer 2 paths in compliance with policy control protocols when at least one of a user makes a request or a status change

15   in the network arises, and controls the ingress node and the plurality of label switch nodes.

2. The label switch network system according to Claim 1, wherein the policy server comprises:

20   a unit for detecting the user request and the status change in the network,

a unit for determining, when transferring the packets in the ingress node, whether existing layer 2 paths are selected to transfer the packets or new layer 2 paths following

25   appropriate routes are to be newly set up, and

a unit for calculating appropriate routes for the

41

layer 2 paths including quality assurance parameters.

3. The label switch network system according to Claim 1, wherein the ingress node comprises:

a unit for notifying the policy server of the user request or the status change in the network when at least one of the ingress node itself detects the user request or the status change in the network and the ingress node collects the user request or the status change in the network from any of the plurality of label switch nodes; and

the policy server comprises:

a unit for instructing the ingress node to set up the layer 2 paths for transferring the packets corresponding to newly generated packet flows, in response to notices sent by the ingress node.

4. The label switch network system according to Claim 1, wherein each of the plurality of label switch nodes comprises:

a unit for routing the packets, and a unit for setting up the layer 2 paths passing through routes specified by IP addresses contained in the packets; and

the policy server comprises:

a unit for specifying one of the plurality of label switch nodes through which a layer 2 path will pass through in accordance with the IP address corresponding to the one of the label switch nodes.

42

5. The label switch network system according to Claim 1, wherein when a plurality of the layer 2 paths exist through which packet flows can pass, new packet flows are generated based on
5 a user request or a detected status change in the network, and
the policy server has a unit that responds to resource utilization conditions of each physical line as collected beforehand, by searching for routes that will keep the resource utilization conditions of each physical line balanced when
10 adding the new packet flows, and a unit for instructing the ingress node to set up the layer 2 paths that can communicate the new packet flows generated in response to the user request or the detected status change in the network.

15 6. The label switch network system according to Claim 1, wherein the ingress node comprises:
a unit for collecting and managing utilization conditions of the layer 2 paths, and
a unit for selecting from among a plurality of layer
20 2 paths through which certain packet flows can pass, the layer 2 paths appropriate for transferring the certain packet flows based on the utilization conditions of the plurality of the layer 2 paths.

25 7. The label switch network system according to Claim 6, wherein the policy server detects newly generated packet flows

generated in response to a user request or a status change in the network, and the policy server comprises:

a unit for instructing the ingress node to set up a plurality of the layer 2 paths which transfer the newly generated packet flows, and

a unit for instructing the ingress node to select the layer 2 paths appropriate for either the packets or the packet flows as a unit so that transferring the new packet flows will not cause any imbalance in the utilization conditions of the plurality of layer 2 paths with each other.

8. The label switch network system according to Claim 1, wherein when a plurality of the layer 2 paths exist through which packet flows can pass, new packet flows are generated by a user request or a detected status change in the network, and the policy server has a unit for searching for at least two different routes for new layer 2 paths to transfer the new packet flows, for generating the new layer 2 paths for transferring the new packet flows, and for designating one of the new layer 2 paths as a working path and the other as a spare path in accordance with resource utilization conditions of each physical line as collected beforehand, and has a unit for instructing the ingress node to switch from the working path to the spare path, based on a judgment at one of the plurality of the label switch nodes when said one of the plurality of the label switch nodes detects a failure in the working path, and

the ingress node has a unit for switching the working
path to the spare path when the ingress node itself detects a
failure in the working path.

5   9. The label switch network system according to Claim 8,
wherein the policy server has a unit for instructing the ingress
node to use the spare path for other traffic when the working
path is normally operating, and to stop the other traffic from
using the spare path and to make the spare path accommodate
10   traffic which the working path was carrying when a failure arises
in the working path.

10. The label switch network system according to claim 1,
wherein one of the layer 2 paths can transfer packets
15   corresponding to a plurality of different packet flows, and
wherein the policy server and the plurality of label switch nodes
each have
          a unit for defining logical groups to which a
plurality of packet flows belong and group identifiers for
20   identifying the groups thereof, and
          a unit for specifying the plurality of packet flows
belonging to the group by the group identifiers when one of the
layer 2 paths is switched; and
          the policy server has a unit for giving instruction
25   to the ingress node so that packet flows and the layer 2 paths
match with each other, making use of the group identifiers when

one of the layer 2 paths is switched.

11. A policy server providing centralized management for a label switch network system having a plurality of label switch nodes interconnected by network links where layer 2 paths are set up by specified routes between the plurality of label switch nodes from a network ingress to a network egress, and

an ingress node disposed at the ingress of the label switch network that transfers packets corresponding to packet flows based on labels, and which selects and sets up layer 2 paths for transferring the packets with reference to the header or payload information of the packets; the policy server comprising:

a receive processing unit for detecting requests or status changes in the network, and

a path creation and transmitting unit responsive to the receive processing unit, for instructing the ingress node to set up the layer 2 paths in compliance with policy control protocols, via the plurality of label switch nodes.

12. The policy server of claim 11, further comprising:

a unit for determining, when transferring the packets in the ingress node, whether existing layer 2 paths are selected to transfer the packets or new layer 2 paths following appropriate routes are to be newly set up, and

a unit for calculating appropriate routes for the

layer 2 paths including quality assurance parameters.

13. The policy server of claim 11, wherein the ingress node
notifies the policy server of the user request or the status
5   change in the network, and

the policy server further comprising:

a unit for instructing the ingress node to set up the
layer 2 paths for transferring the packets corresponding to
newly generated packet flows, in response to notices sent by the
10 ingress node.

14. The policy server of claim 11, wherein the packets are
IP packets and contain IP addresses, and

the policy server comprises:

15 a unit for specifying one of the plurality of label
switch nodes through which a layer 2 path will pass through in
accordance with the IP address corresponding to the one of the
label switch nodes.

20 15. The policy server of claim 11, wherein the packets are
IP packets and a plurality of the layer 2 paths through which
IP flows can pass exist, new IP flows are generated based on a
user request or a detected status change in the network, and

the policy server further comprises:

25 a unit that responds to resource utilization
conditions of each physical line as collected beforehand, for

searching routes that will keep the resource utilization
conditions of each physical line balanced when adding the new
IP flows, and

a unit for instructing the ingress node to set up the
5   layer 2 paths that can transfer the new IP flows generated in
response to the user request or the detected status change in
the network.

16. The policy server of claim 11, wherein the policy server
10 detects newly generated packet flows generated based on a user
request or a status change in the network, and the policy server
further comprises:

a unit for instructing the ingress node to set up a
plurality of the layer 2 paths which transfer the newly generated
15 packet flows, and

a unit for instructing the ingress node to select the
layer 2 paths appropriate for either the packets or the packet
flows as a unit so that transferring the new packet flows will
not cause any imbalance in the utilization conditions of the
20 plurality of layer 2 paths with each other.

17. The policy server of claim 11, wherein when a plurality
of the layer 2 paths exist through which packet flows can pass,
new packet flows are generated by a user request or a detected
25 status change in the network, and the policy server further
comprises:

48

a unit for searching for at least two different routes for new layer 2 paths to transfer the new packet flows, for generating the new layer 2 paths for transferring the new packet flows, and for designating one of the new layer 2 paths as a working path and the other as a spare path in accordance with resource utilization conditions of each physical line as collected beforehand, and

a unit for instructing the ingress node to switch from the working path to the spare path, based on a judgment of at one of the plurality of the label switch nodes when the at one of the plurality of the label switch nodes detects a failure in the working path.

18. The policy server of claim 17, further comprises:

a unit for instructing the ingress node to use the spare path for other traffic when the working path is normally operating, and to stop the other traffic from using the spare path and to make the spare path accommodate traffic which the working path was carrying when a failure arises in the working path.

19. The policy server of claims 11, wherein the packets are IP packets, and the policy server further comprises:

a unit for defining logical groups, having group identifiers, to which a plurality of IP flows belong when one of the layer 2 paths transfers the IP packets corresponding to

a plurality of different IP flows,

a unit for specifying the plurality of IP flows belonging to the group by the group identifiers when one of the layer 2 paths is switched, and

5   a unit for giving instruction to the ingress node so that IP flows and the layer 2 paths match with each other, using the group identifiers when one of the layer 2 paths is switched.

20. A method for setting up and selecting layer 2 paths for

10   transferring IP packets in a label switch network system having a plurality of label switch nodes interconnected by network links where layer 2 paths are set up by specified routes between the plurality of label switch nodes from a network ingress to a network egress, and an ingress node disposed at the ingress

15   of the label switch network system that transfers the IP packets corresponding to IP flows based on labels; the method comprising the steps of:

detecting requests and status changes in the network,

determining, when transferring the IP packets in the

20   ingress node, whether existing layer 2 paths are selected to transfer the IP packets or new layer 2 paths following appropriate routes are to be newly set up,

calculating appropriate routes for the layer 2 paths including quality assurance parameters,

25   instructing the ingress node to set up the layer 2 paths in compliance with policy control protocols, and

transferring the IP packets with reference to the
header or payload information of the packets.

21. The method of claim 20, further comprising the steps
of:

notifying a policy server of the user request or the
status change in the network, and

in the policy server, instructing the ingress node to
set up the layer 2 paths for transferring the IP packets
corresponding to newly generated IP flows, in response to the
notifying step.

22. The method of claim 21, further comprising the step of:

in the policy server, specifying one of the plurality
of label switch nodes through which a layer 2 path will pass
through in accordance with an IP address corresponding to the
one of the label switch nodes.

23. The method of claim 21, further comprising the steps
of:

generating new IP flows based on a user request or a
detected status change in the network,

balancing resource utilization conditions of each
physical line by searching for routes that will keep the resource
utilization conditions of each physical line balanced when
adding the new IP flows when a plurality of the layer 2 paths

exist through which IP flows can pass, and

instructing the ingress node to set up the layer 2 paths that can transfer the new IP flows generated.